

WHAT IS CLAIMED IS:

1. A ferroelectric thin film element comprising a substrate and an epitaxial ferroelectric thin film provided on said substrate:

5        wherein said epitaxial ferroelectric thin film satisfies a relation  $z/z_0 > 1.003$  wherein a crystal face parallel to a crystal face of a surface of the substrate among crystal faces of said epitaxial ferroelectric thin film is taken as a Z crystal face,  
10    a face spacing of said Z crystal face is taken as  $z$  and a space of the Z crystal face of a material constituting said epitaxial ferroelectric thin film in a bulk state is taken as  $z_0$ , and also satisfies a relation  $0.997 \leq x/x_0 \leq 1.003$  wherein one of crystal  
15    faces of said epitaxial ferroelectric thin film perpendicular to the Z crystal face is taken as an X crystal face, a face spacing of the X crystal face is taken as  $x$  and a face spacing of the X crystal face of the material constituting said epitaxial  
20    ferroelectric thin film in a bulk state is taken as  $x_0$ .

2. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin  
25    film has a thickness within a range of 2 to 100 nm.

3. A ferroelectric thin film element according

to claim 1, further comprising at least a buffer layer between said substrate and said epitaxial ferroelectric thin film.

5           4. A ferroelectric thin film element according to claim 3, wherein at least one of said substrate and said buffer layer is electroconductive.

10           5. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film has a crystal orientation degree of the Z crystal face, measured by a  $2\theta/\theta$  method with an X-ray incident angle  $\theta$  to the Z crystal face, is 90 % or higher.

15           6. A ferroelectric thin film element according to claim 1, wherein said Z crystal face has a crystal orientation degree of 99 % or higher.

20           7. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film has a perovskite structure.

25           8. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film includes a lead (Pb) atom or an oxygen (O) atom as a constituent atom.

9. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film has a tetragonal crystal structure and the Z crystal face is a (001) face.

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10. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film has a rhombohedral crystal structure and the Z crystal face is a (111) face.

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11. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film has a hexagonal crystal structure and the Z crystal face is a (0001) face.

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12. A ferroelectric thin film element according to claim 1, wherein said epitaxial ferroelectric thin film has a rhombic crystal structure and the Z crystal face is a (011) face.

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13. A piezoelectric actuator comprising a substrate and an epitaxial ferroelectric film provided on said substrate:

25 wherein said epitaxial ferroelectric film satisfies a relation  $z/z_0 > 1.003$  wherein a crystal face parallel to a crystal face of a surface of the substrate among crystal faces of said epitaxial

ferroelectric film is taken as a Z crystal face, a face spacing of said Z crystal face is taken as  $z$  and a space of the Z crystal face of a material constituting said epitaxial ferroelectric film in a bulk state is taken as  $z_0$ , and also satisfies a relation  $0.997 \leq x/x_0 \leq 1.003$  wherein one of crystal faces of said epitaxial ferroelectric film perpendicular to the Z crystal face is taken as an X crystal face, a face spacing of the X crystal face is taken as  $x$  and a face spacing of the X crystal face of the material constituting said epitaxial ferroelectric film in a bulk state is taken as  $x_0$ .

14. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric thin film has a thickness within a range of 100 nm to 10  $\mu\text{m}$ .

15. A piezoelectric actuator according to claim 13, further comprising at least a buffer layer between said substrate and said epitaxial ferroelectric film.

16. A piezoelectric actuator according to claim 15, wherein at least one of said substrate and said buffer layer is electroconductive.

17. A piezoelectric actuator according to claim

13, wherein said epitaxial ferroelectric film has a crystal orientation degree of the Z crystal face, measured by a  $2\theta/\theta$  method with an X-ray incident angle  $\theta$  to the Z crystal face, is 90 % or higher.

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18. A piezoelectric actuator according to claim 13, wherein said Z crystal face has a crystal orientation degree of 99 % or higher.

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19. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric film has a perovskite structure.

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20. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric film includes a lead (Pb) atom or an oxygen (O) atom as a constituent atom.

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21. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric film has a tetragonal crystal structure and the Z crystal face is a (001) face.

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22. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric film has a rhombohedral crystal structure and the Z crystal face is a (111) face.

23. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric film has a hexagonal crystal structure and the Z crystal face is a (0001) face.

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24. A piezoelectric actuator according to claim 13, wherein said epitaxial ferroelectric film has a rhombic crystal structure and the Z crystal face is a (011) face.

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25. A liquid discharge head for discharging a liquid utilizing a piezoelectric actuator according to claim 13.